Monitoring of the Triclosan in Foodstuffs

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Triclosan (2,4,4-trichloro-2-hydroxyphenyl ether)
CAS nº. 3380-34-5

Broad-spectrum antimicrobial agent

According to EU Biocide Directive 1998/8/EC, triclosan is used in:

- Products type 1 (human hygiene),
- Products type 2 (private and public health area),
- Products type 3 (veterinary hygiene),
- Products type 7 (film preservative),
- Products type 9 (fibre, leather, rubber and polymerized materials preservative).

Dilemma between effective disinfection and formation of harmful disinfection byproducts.

Triclosan is banned in EU from 01/10/2011

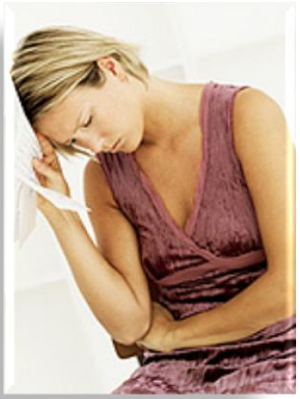
- Since 1986, triclosan was listed in the European Community Cosmetics Directive (76/768/EEC) for use at concentrations up to 0.3%.

- In 2010 EU Scientific Committee finally concluded that triclosan can trigger the expression of resistance and cross-resistance in bacteria.

- In 08/10/2010 Commission published the decision [2010/675/EU] addressed to the Member States: "For the purposes of Article 4(2) of Regulation (EC) No 1451/2007, *biocidal products containing active substances for the product-types indicated in the Annex to this Decision shall no longer be placed on the market with effect from 01/10/2011*".

Triclosan is listed

Challenges

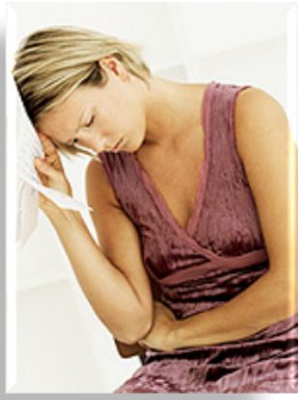


- ✓ Level of triclosan in humans has dramatically increased.

- ✓Humans exposed thought both usage of certain antimicrobial products (bioconcentration) and eating contaminated food (biomagnification).

- ✓ 75% of the US population has triclosan in their bodies [data of Centers for Disease Control and Prevention], nationwide study of the U.S. population's exposure to environmental chemicals.

Challenges



Toxic Characteristics of triclosan

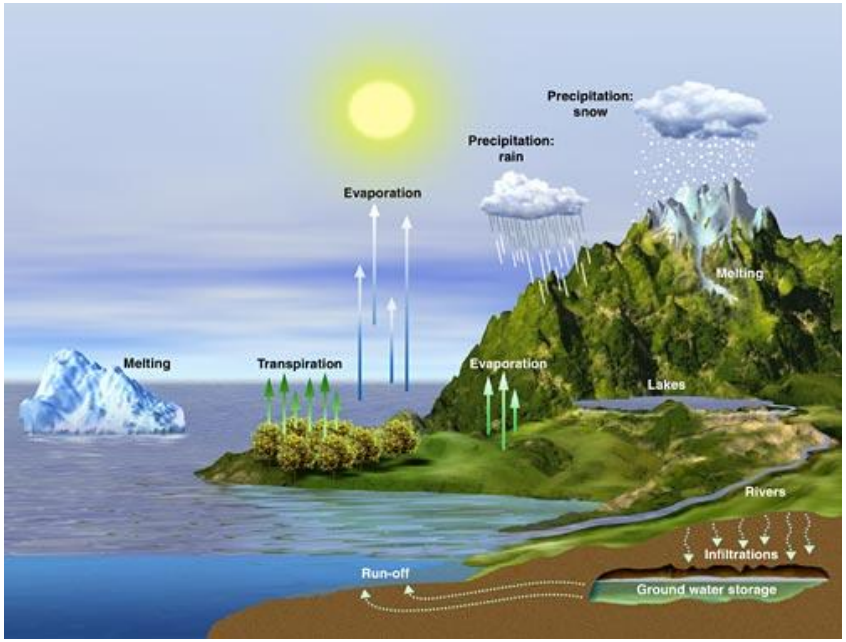
- Might act as an antibiotic and will cause resistant bacterial strains.
- Might react with chlorinated water to produce significant quantities of chloroform.
- Could react to form byproducts that include chlorinated phenoxy-phenols, chlorinated phenols, and trihalomethanes.

Antibiotic resistance is an increasingly serious problem worldwide, and continued use of the biocides exacerbates this problem

Challenges

Both triclosan and its transformation product are found in wastewater treatment plants effluent, about 96% of triclosan from consumer products is disposed of in residential drains.

This leads to large loads of the chemical in water entering wastewater treatment plants, which are incompletely removed during the wastewater treatment process.



Triclosan also accumulates in the environment, contaminating surface and groundwater

Triclosan and its transformation product first aggregate in wastewater sludge and are transferred to soils and natural water environments, where they were observed to persist for months or years.

Project Idea

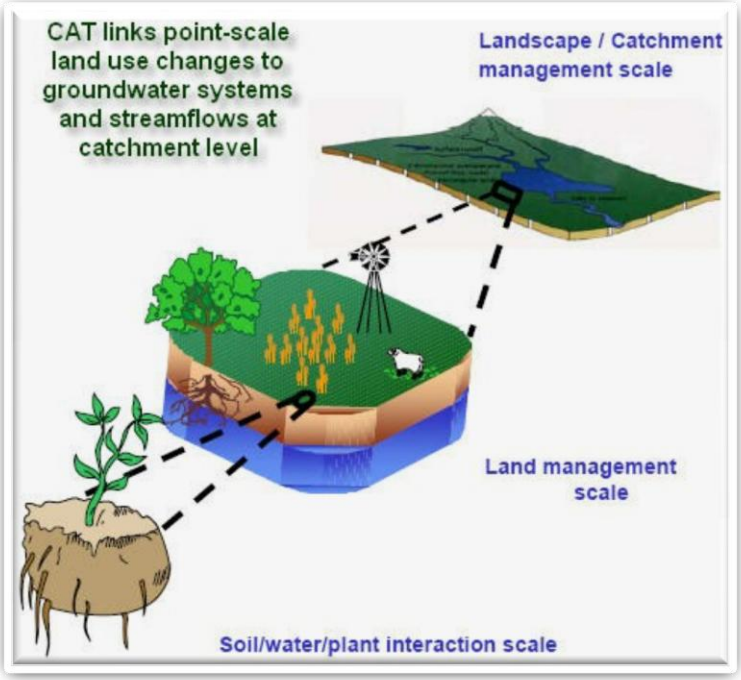
- Follow *the pathways* of triclosan into a food supply;
- To answer the questions:
  - *How much* triclosan is in our food;
  - How can we *better manage* this situation.

- Wastewater treatment process and persists in sludge is dumped on agricultural crops;

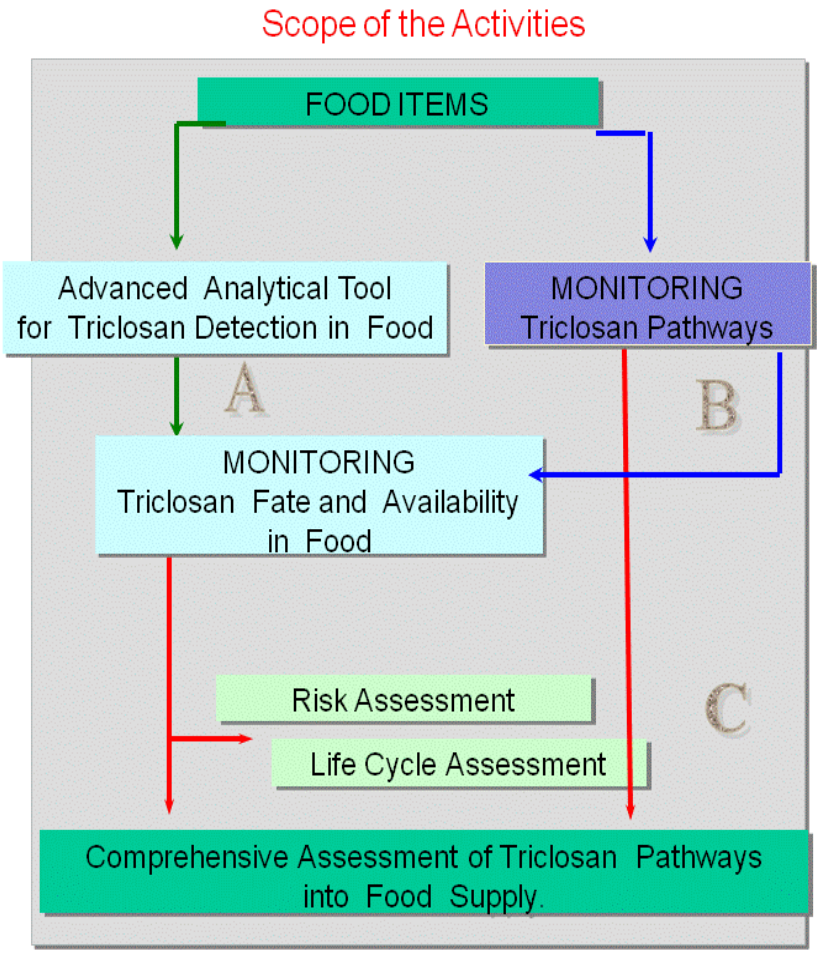
- Plants can absorb triclosan and its transformation product through their roots and then into the beans;

- The potential for these chemicals to migrate into food or leach into groundwater, has not received adequate consideration;

- It is likely that antimicrobials are capable of moving up the food chain, through a process known as biomagnification.



Project Tasks



- Integrated Monitoring/Mapping of Triclosan Fate and Pathways into the Food supply;

- Wastewater and sludges of the six WWTPs from different industrial and agricultural sites of North and South of Portugal will be analysed aimes at triclosan detection;

- Monitoring of the Triclosan Fate and Availability in Food;

- Reference onset of the plant and animal food items will be chosen and inquiries will be made aim at food items distribution and origin in order to link the pathways form WWPs to Food supply chain;

- Appropriative action foreseen, i.e. studies on WWPS stocks Purification from Triclosan using activated carbons.

Chosen WWTPs:

1. North:

- Viana do Castelo;
- Monção.

2. South:

- Seixalinho;
- Pinhal Novo;
- Cucena.

1st Case study: North

Viana do Castelo:

North

- Viana's municipality is placed in portuguese coast, 60 km faraway from Vigo (Galiza - Spain) by North, and also at the same distance from Oporto, by South.

- In the socio-economic, Viana do Castelo is growing strongly, especially: shipbuilding, manufacturing, trade and services, and tourism.

- The WWTP has a treatment with secondary level (activated sludge systems of average load), and after treatment, the treated wastewater are subjected to a step pitch held in infiltration basins. This system allows the discharge of wastewater consistent with the requirements of the receiving environment.

1st Case study: North

North

Monção:

- Monção`s municipality is located in the northern limit of Portugal by entering into a relatively small region in terms of land area, the Alto Minho. Establishes border with Spain, across the Rio Minho.

- Agricultural Resources and Forestry is a major capabilities of the County, given the occurrence of good fertile soil across the floodplain.

- Monção`s municipality has rural characteristics, with scattered small clusters of activities mainly related to the primary sector.

1st Case study: North

North

Monção:

- The system of sewerage consists of a set of network-type unit (given the mix of domestic wastewater and stormwater) that are organized into two distinct systems.

Each system integrates a set of collectors, pipelines and pumping outfalls (drainage system) and equipment (pumping stations and treatment plant) that allow for collection and transportation of urban waste water from the dwellings to the place of treatment - Treatment Plant Wastewater (WWTP).

2nd Case study: South

South

Setúbal:

- The district of Setúbal has about 16,100 inhabitants.

- This district is characterized by a highly heterogeneous landscape. Part of the municipal territory is integrated in the Natural Reserve of the Sado Estuary and another in the Natural Park of Arrábida.

- The territory is divided into 13 counties, including: Montijo Palmela, Sesimbra.

2nd Case study: South

Pinhal Novo:

- The Pinhal Novo WWTP is in operation since 2002.

- The infrastructure has the capacity to carry out the treatment of 3,600 m^3/day of waste water, corresponding to about 23,500 equivalent inhabitants.

- The treatment level installed is secondary with disinfection in line for production of water for reuse in late compatible.

2nd Case study: South

Seixalinho:

The Seixalinho WWTP is located in Montijo`s municipallity .

- The infrastructure has the capacity to carry out the treatment of 14,400 m^3/day of waste water, corresponding to about 48,00 equivalent inhabitants.

- The treatment level installed is terciary with final disinfection and desodorization.

2nd Case study: South

Cucena:

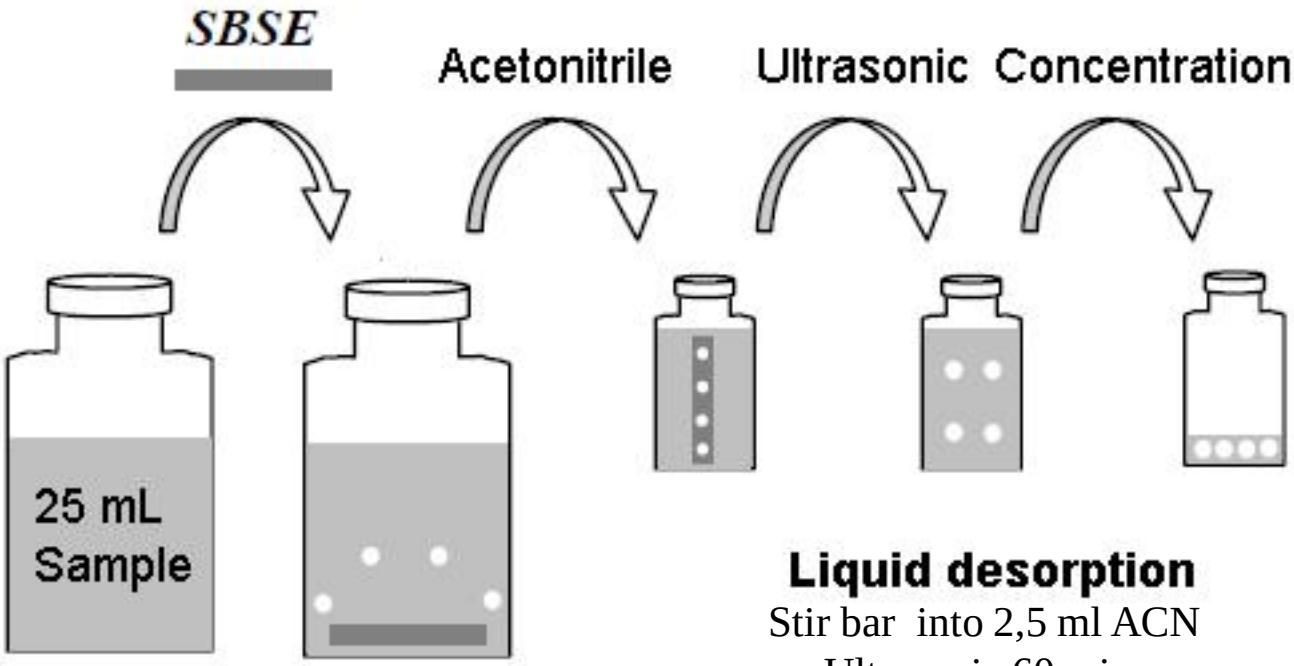
- The Cucena WWTP is located in Seixal`s municipallity and is in operation since 1996.

- The infrastructure has the capacity to carry out the treatment of 3,360 m^3/day of waste water, corresponding to about 24,000 equivalent inhabitants.

- The treatment level installed is secondary with disinfection, being the WWTP also endowed with a deodorizing system.

Method of triclosan detection in a wastewater

Stir Bar Sorptive Extraction



Extraction

25 ml sample + stir bar
1h, 1000rpm

Liquid desorption

Stir bar into 2,5 ml ACN
Ultrasonic 60 min;

•UV-Vis spectral detection at 230 nm

Samples was evaporated to dryness under N_2 (>99.5%)

The dried residues were redisolved in 0.2 ml MeOH;

•Placed into automatic liquid sample tray for LC-DAD.
•C18 HPLC column , 150mm×2.1mm, 5µm
•The mobile phase MeOH and ultra-pure water (95/5%)
•Flow of 0.5 mL/min (25^0C, 232 bar).
The injection volume 10 µL

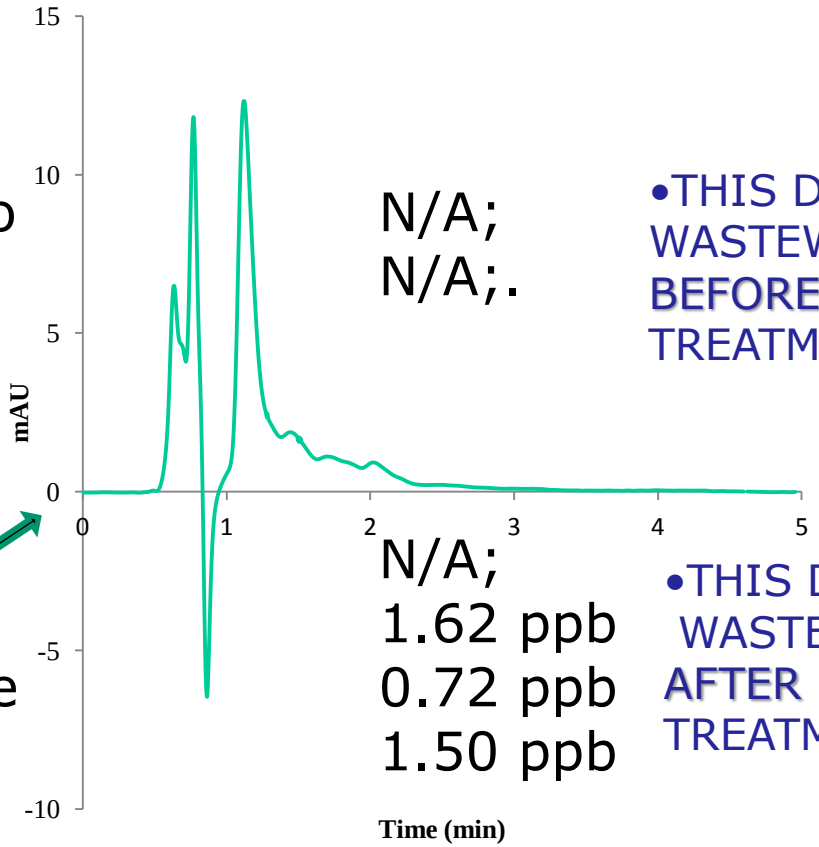
RESULTS on Triclosan detection for WWTPs

North:

- Viana do Castelo
- Monção

South:

- Seixalinho
- Pinhal Novo
- Quinta de Conde
- Cucena



N/A;
N/A;.

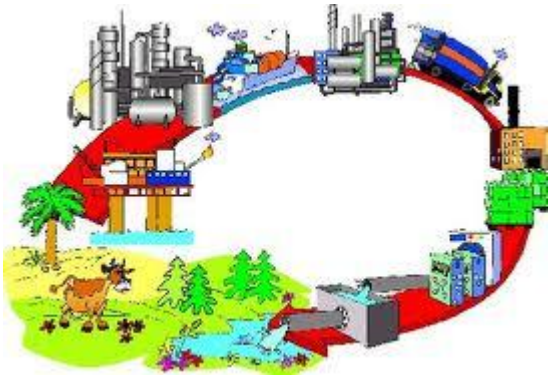
N/A;
1.62 ppb
0.72 ppb
1.50 ppb

•THIS DATA FOR WASTEWATER SAMPLES **BEFORE** and **AFTER** TREATMENT AT WWTPs

•THIS DATA FOR WASTEWATER SAMPLES **AFTER** TREATMENT AT WWTPs

Next steps

The following S&T environmental services will be provided:



- ✓ Monitoring of the Triclosan Fate and Availability in Food;
- ✓ Risk Assessment (RA);
- ✓ Life Cycle Assessment (LCA)
- ✓ WWTPs stocks Purification Tests from triclosan using activated carbons;

based on the obtained results

- ✓ Appropriative *actions/recommendation* to the suppliers/customers

will be proposed aiming at successful implementation of *the EU Commission decision [2010/675/EU]* addressed to the Member States on triclosan ban by November 2011

Thank you for your attention